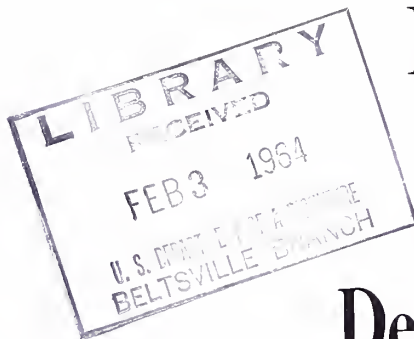


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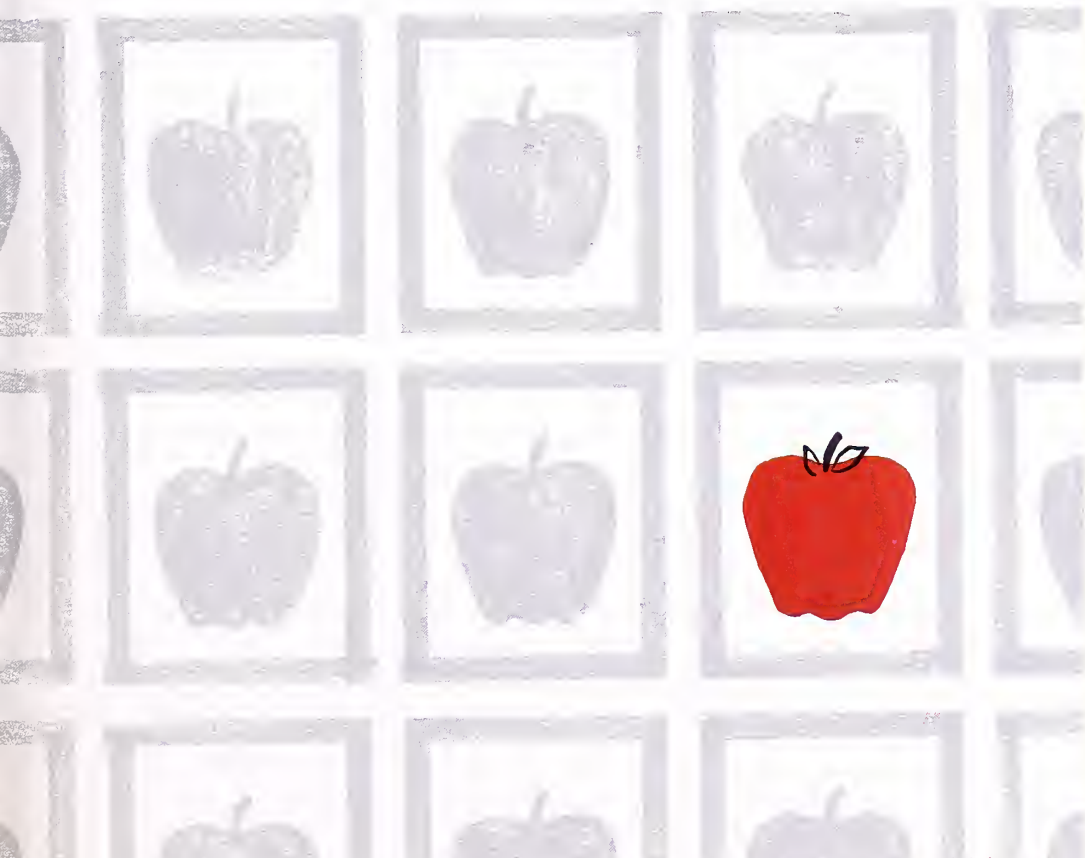
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How Color of Red Delicious Apples Affects Their Sales

MARKETING RESEARCH REPORT NO.618



Preface

This report describes customer response, in terms of actual purchase volume, to Red Delicious apples segregated and displayed in retail food stores on the basis of varying degrees of good red color. It is intended as a source of information for use by producers in decision making regarding sorting, grading, and selling, and by marketing agents in purchasing and merchandising apples. The study is a part of the program of marketing research conducted by the Economic Research Service to evaluate and improve merchandising practices for farm products.

This study was carried out in cooperation and with the support of the National Apple Institute. Colonial Stores made available retail stores in Atlanta, Ga., as laboratories for the experimental work. The research was under the general direction of Robert E. Frye and William S. Hoofnagle.

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February 1964

Summary

A study of customer buying response to the color of Red Delicious apples showed that retail sales of highly colored apples (from 75 to 100 percent good red color) were significantly greater than sales of partly red apples (50 to 75 percent good red color).

Equal proportions of the highly colored and partly red apples were combined and offered to store customers in a single display having 50 to 100 percent good red color. Sales from this combination display were significantly less than sales of highly colored apples but greater than those of partly red ones when each color was displayed separately. All test fruit was offered in bulk displays, and prices were the same for the test apples in each of the three color ranges offered.

In seven of the nine retail food stores where tests were conducted, highly colored apples outsold those from the combination display. In all stores the highly colored apples outsold partly red apples. During 4 of the 6 weeks of the experiment, total sales of highly colored apples were larger than sales from combination displays and in all weeks higher than sales of partly red ones.

Sales from the combination display were higher than from displays of partly red apples in eight of the nine test stores and during all 6 weeks of the test period.

Sales of test apples had no significant effect on total sales of other apples.

Spoilage was greater in the combination display than in the displays of partly red or highly colored test apples. Loss from spoilage amounted to over 5 percent of the total movement from the combination display. Only about 1 percent of the partly red and hardly any of the highly colored test apples were lost because of spoilage.

The higher rate of spoilage for the combination display appears to have resulted from more handling of individual fruit by customers. Despite higher spoilage loss, the combination display produced higher sales and greater gross profit to the retailer than displays of partly colored test fruit.

These findings are from a study conducted during a 6-week period in late 1961 in nine retail food supermarkets in Atlanta, Ga.

HOW COLOR OF RED DELICIOUS APPLES AFFECTS THEIR SALES

By Hugh M. Smith and Robert E. Frye, Agricultural Economists, Market Development Branch, Marketing Economics Division, Economic Research Service

Background and Purpose

A large portion of eastern-grown Red Delicious apples are not uniformly deep red at maturity. Lack of red color or variation in color between individual fruits is due to several reasons. One of these is the existence of several strains of Red Delicious. Also, climatic and growing conditions affect color. Producers have generally found that partly colored Red Delicious can be sold only at a price somewhat lower than that commanded by the small proportion of the Red Delicious crop which, under normal conditions, has uniform and deep red coloring.

Since the fresh market is by far the major outlet for Red Delicious, existing price differentials are of major significance and concern to growers. Full coloring of the fruit is also a problem to growers of other major varieties of red apples.

Existing pricing practices which place a premium on highly colored fruit may also encourage cultural practices that adversely affect the quality of fruit available to consumers. For example, growers in an effort to obtain better color in their apples and hence higher prices may leave fruit on the tree beyond its optimum maturity. Overmature apples become more susceptible to bruising and are likely to have a shorter shelf life than fruit harvested at proper maturity. Thus better color is gained at the expense of other quality factors, and the overall condition of the fruit when it reaches the consumer may have a bad influence on purchases and demand.

While a trade preference, reflected in the prices paid for highly colored Red Delicious, has been a fact of life for some time, little information is available to show whether this pricing procedure is a true reflection of consumer demand.

A deep and uniform color apparently has been the principal factor influencing differential pricing. Apples of otherwise comparable quality are normally purchased at lower prices by wholesalers or retailers.

Prior to initiation of this study, industry representatives had expressed the opinion that partly colored Red Delicious were as attractive as solid dark reds, provided the colors were good (not too pale and not too dark) and fairly uniform. Many producers also voiced the opinion that lower prices received for partly colored Red Delicious resulted from their poor appearance caused by failure to sort them into narrow color ranges or uniformly colored lots. Just as sorting apples by size has been found to enhance their appearance and create a product more attractive to both planned and impulse buying, producers have questioned whether a similar response could not be ex-

pected to partly colored fruit if it were segregated from both fully colored or poorly colored fruit.

The retail outlet is the point where consumers through their purchases indicate their preferences. Determination of the degree of consumer acceptance of Red Delicious apples graded more uniformly with respect to color was undertaken to (1) learn whether a premium price for highly colored apples is justified on the basis of consumer purchases, and (2) obtain information which the industry could use in evaluating current grading and sorting practices in respect to color. Retail sales of Red Delicious apples having color ranges of 50 to 75 percent, 75 to 100 percent, and 50 to 100 percent, provide the industry with a firsthand measure of comparative consumer acceptance of apples of each color.

Procedure

Eastern Red Delicious apples in three color ranges were tested in nine large retail food supermarkets in the Atlanta, Ga., metropolitan area during a 6-week period beginning in late October 1961. Each color range was tested for a 2-week period in each store. Each color range of test apples was available in three of the test stores at any given point of time and the three color ranges were available in each of the nine stores during 2 weeks of the 6-week test period. Consumers were exposed to only one color range or a single treatment of the test fruit at any one time. The three color ranges of Red Delicious apples, each of which was designated a treatment, were:

Treatment A—"highly colored," 75 to 100 percent good red color.

Treatment B—"partly red," 50 to 75 percent good red color.

Treatment C—"combination," 50 to 100 percent good red color (a mixture of equal quantities of treatment A and B test apples).

The color ranges in each treatment are shown in figure 1.

At one stage in the planning of this study, consideration was given to testing Red Delicious sorted into 40 to 60 percent good red color, 60 to 80 percent, and 80 to 100 percent. However, Red Delicious having less than 50 percent good red color were considered to have insufficient color to compete with highly colored fruit. Consequently, Red Delicious having a minimum of 50 percent good red color and a maximum of 75 percent were selected to be competitive in attractiveness to highly colored Red Delicious having 75 to 100 percent good red color. Fruit in this top color range would normally command highest prices. Apples having 50 to 100 percent good red color were selected to represent wide variation in color and at the same time a color range in which Red Delicious are often sorted and marketed.

A latin square experimental design was used to assign treatments to stores and time periods. Rotation of each color range or treatment according to the experimental design equalized the sales effects of nontest variables, such as difference in size and location of stores, seasonality of demand, competition of other products, and difference in preferences and incomes of customers patronizing each test store. Initially, test stores were selected so as to minimize sales differences due to size of store, but were distributed geographically to represent consumers with varying socioeconomic characteristics.

Effects of certain other factors that could influence sales, such as price and size of display, were minimized by holding the factors constant or changing them at the same time in all test stores. For



Figure 1.—Apple color ranges included highly colored (left), partly red (center), and a combination of red and partly red (right).

example, the size, location, and type of display in a test store were held constant for all treatments through prior approval of store management. Prices of test apples did not change during the test period and were the same in all test stores. Test apples were not advertised or promoted during the experimental period. Merchandising practices for all other fruit were relatively uniform for all test stores. Merchandising practices for test apples as well as nonexperimental commodities could be controlled because all test stores were under the same management.

Except for the indicated controls imposed, data were obtained under normal operating conditions. An enumerator maintained test apple displays in a prescribed and uniform manner for each treatment. In addition, the enumerator maintained information on sales volume and spoilage of test fruit and obtained, through periodic audits, sales records for other apples. A customer count for each store was obtained through cash register recordings.

Test apples were sorted in the specified color ranges in the production area and shipped to a public cold storage warehouse in Atlanta. Enumerators withdrew supplies and delivered them directly to test stores as needed.

Results

During the 6-week experiment, almost 4,500 pounds of highly colored (treatment A) Red Delicious apples were sold in the nine test supermarkets (table 1). This was a 50 percent larger volume than for partly reds (treatment B) and 16 percent more than for combination color (treatment C). Combination displays offering consumers test apples that were 50 to 100 percent red moved 29 percent more than displays of partly red fruit—50 to 75 percent red. All sales of test fruit were at 19 cents a pound.

TABLE 1.—*Sales of Red Delicious apples sorted and displayed by color in 3 ways, 9 retail food stores, Atlanta, Ga., Oct. 30-Dec. 9, 1961¹*

Color range: Percent of good red color	Quantity sold	Sales reduction from treatment A
	Pounds	Percent ²
Treatment A—75 to 100 percent (highly colored) -----	4, 497	-----
Treatment B—50 to 75 percent (partly red)-----	2, 994	33
Treatment C—50 to 100 percent (combination of red and partly red)-----	3, 861	14

¹ The probability that sales differences between any 2 color ranges may have been due to chance is as follows: Treatments A and B, 1 chance per 1,000; treatments A and C, 2 chances per 100; treatments B and C, 5 chances per 100.

² Using actual sales in pounds for all 3 treatments with sales in treatment A as base.

On a per customer basis, the sales response to the three color ranges tested was similar to that of total sales. Applying a simple adjustment for number of store customers, sales of highly colored test fruit averaged 6.2 pounds per 100 customers or almost 48 percent more than the 4.2 pounds for partly reds. Movement from the combination

displays was at the rate of 5.6 pounds per 100 customers—almost 10 percent lower than for highly colored, but 33 percent greater than for partly reds. Combined sales of all three color ranges averaged slightly more than 5 pounds per 100 customers.

Differences in sales between each of the color ranges or treatments were statistically significant for both total sales and sales per 100 customers.¹

Test apple sales averaged 16 percent of total apples sales in the nine test stores during the 6-week study. Sales of test apples had no significant influence on the total sales of other apples, irrespective of the color being tested (fig. 2).

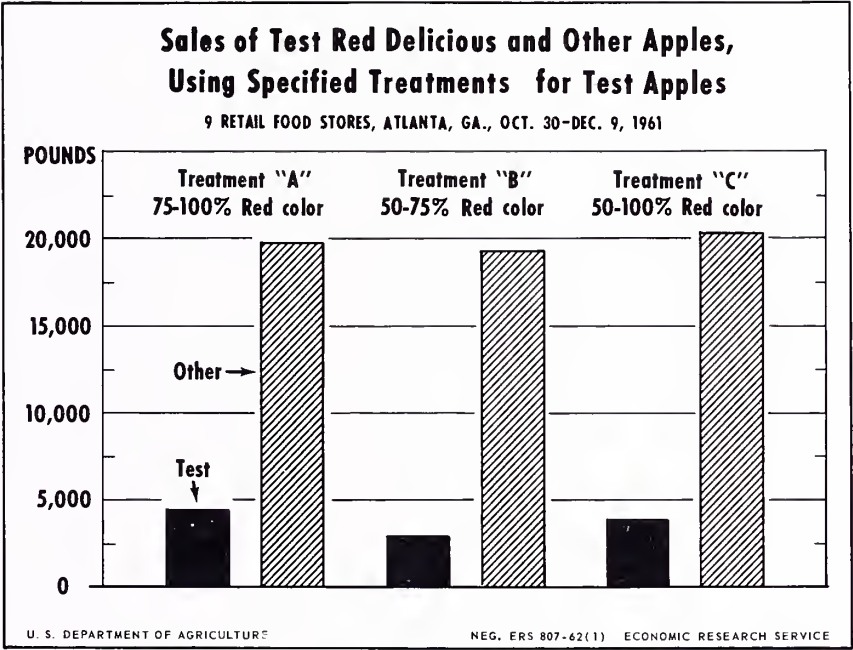


Figure 2

Sales in Individual Test Stores

To determine the degree of consistency of sales among test stores for each treatment or color range, adjustments were made to eliminate variation due to differences in time. The resulting comparisons showed that highly colored apples sold best in seven of the nine stores (fig. 3). In one store, sales from the combination display were highest—about 4 pounds greater per 100 customers than for highly colored—and in another store, sales were practically the same as highly colored

¹ The color ranges of the test fruit and the fact that equal prices were charged for all ranges should be recognized in evaluating the significance of the findings. It is not possible, for example, to predict, from the result of this test, sales in the various color ranges if price differentials were imposed or if other color ranges of test fruit were offered.

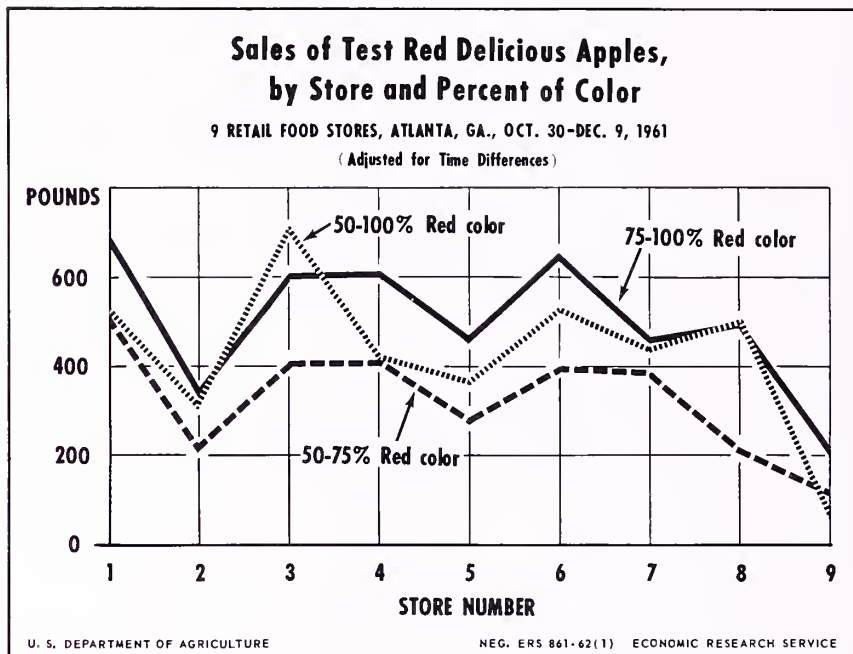


Figure 3

apples. Sales from displays of partly reds were less than of other test apples in eight out of nine stores. However, in one store, partly reds sold more than the combined color but less than fully colored.

Sales by Time Periods

An average of 210 pounds of test apples were sold per store each week. There was, however, considerable variation from store to store, ranging from 78 pounds in one store up to 286 pounds in another. Sales of test apples declined gradually throughout the experiment but total sales of other apples also declined (fig. 4).

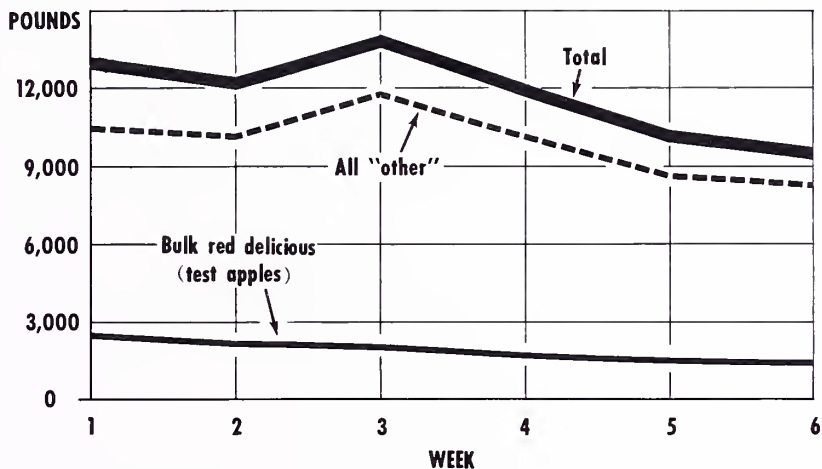
To examine the consistency of sales for each color range from one week to another, sales were adjusted to eliminate variations due to differences in sales levels between test stores. After this adjustment, it was found that highly colored apples sold best during 4 of the 6 test weeks (fig. 5). The combination display sold more than the highly colored displays the second and third weeks, which were the weeks between Halloween and Thanksgiving. During all weeks of the study, partly red apples were purchased in smaller volume than either of the other color ranges tested. Sales from the combination display were less than from the display of highly colored apples, except for 2 of the test weeks, but were always greater than from the display of partly red.

Total Sales of Apples

An average of 1,312 pounds of apples were sold per store each week of the study. This was an average of 32 pounds for each 100 customers

Sales of Test Red Delicious Apples, Compared With Other Apples

9 RETAIL FOOD STORES, ATLANTA, GA., OCT. 30-DEC. 9, 1961



U. S. DEPARTMENT OF AGRICULTURE

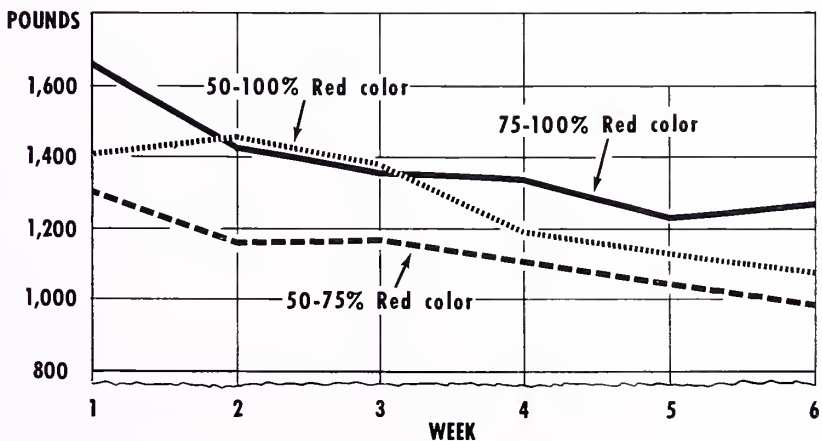
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Figure 4

Sales of Test Red Delicious Apples, by Weeks and Percent of Color

9 RETAIL FOOD STORES, ATLANTA, GA., OCT. 30-DEC. 9, 1961

(Adjusted for Store Variation)



U. S. DEPARTMENT OF AGRICULTURE

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Figure 5

patronizing the test stores (table 2). Red Delicious apples, including test and nontest fruit, represented about 39 percent of the total apple sales in test stores or slightly more than 12 pounds per 100 customers. Other major varieties handled were Stayman Winesap, Rome Beauty, and York. Total sales of apples in the test stores dropped each week during the study except for the third week, when sales were the highest.

Spoilage

Spoilage of all apples during the 6-week test period averaged about 1 percent of sales, ranging from almost negligible for cooking apples to over 2 percent for test red apples.

TABLE 2.—*Retail apple sales and spoilage by variety in 9 retail food stores, Atlanta, Ga., Oct. 30-Dec. 9, 1961*

Variety	Sales per week		Spoilage as percent of sales
	Per store	Per 100 customers	
	<i>Pounds</i>	<i>Pounds</i>	<i>Percent</i>
Test Red Delicious.....	210. 22	5. 08	¹ 2. 3
Other Red Delicious.....	298. 22	7. 21	. 2
Golden Delicious.....	152. 09	3. 67	1. 8
Stayman Winesap.....	292. 15	7. 06	. 8
Yates.....	28. 45	. 69	1. 8
Rome Beauty and York.....	330. 61	7. 99	. 4
All varieties.....	1, 311. 74	31. 70	. 9

¹ Spoilage for color ranges as a percent of sales is as follows: 75-100% good red color, 0.2 percent; 50-75% good red color, 1.3 percent; 50-100% good red color, 5.4 percent.

Spoilage of highly colored test apples amounted to 0.2 percent of sales compared with 1.3 percent for partly red apples and 5.4 percent for combination color. Spoilage of highly colored Red Delicious cost the retailer 2 cents per 44-pound box, compared with 11 cents per box of the combination.² During the 6-week experiment, this amounted to losses of \$1.71 for highly colored Red Delicious, \$7.41 for partly red, and \$39.52 for the combination display.

Handling of apples by customers in selecting individual fruit appeared to have been the principal cause of the higher spoilage rate in combined color displays. A higher degree of selectivity on the part of customers was encouraged by the wide range in color available in the test fruit in this treatment. In other respects, quality characteristics and factors such as stocking and displaying procedure that might influence the spoilage level were the same for all test fruit.

The high spoilage in combined color displays was more than offset by higher sales and higher gross profit than the partly red display.

² Calculations based on retail price of 19¢ per pound.

Implications

It can be concluded from the findings of the study that customers prefer high color in their Red Delicious apples and will buy more when they are offered a high percentage of good red color. Findings and conclusions that may be drawn, of course, are applicable only under conditions similar to those imposed or characterizing this study.

Different results may have occurred if narrower color ranges that would have resulted in less color contrast between treatments had been imposed. Neither can we conclude what consumer acceptance would have been if differential pricing had been utilized for the color ranges tested. However, the strong acceptance shown, and the fact that the trade generally offers more for highly colored fruit suggests that a premium price may be justified. These conditions further point up the need for examination and evaluation of current sorting practices in regard to color.

Costs of sorting into narrower color ranges and under varying crop conditions must be weighed against the anticipated marketing returns. Ultimately, these returns will reflect consumer willingness to buy Red Delicious at a premium or discount for varying degrees of color.

Producers in evaluating their sorting or grading practices will recognize that a market must be found for both highly colored and partial color, or the color ranges that come off the tree. While highly colored fruit may command a premium that will insure adequate returns for sorting, its potential must be weighed against its effect on returns for the poorly colored part of the crop. The producer's combined return for his total production will be the prime consideration in determining color sorting practices. To provide a sound basis for establishing sorting practices, the prices consumers are willing to pay for varying degrees of color in Red Delicious must be known. With this information, the producer can weigh the condition of his crop and the cost of sorting, and adopt practices that will bring the highest return for his production.

If it is found that consumers are willing to pay a premium for high color in Red Delicious, the industry must then consider the best way of meeting or changing this demand. If partly colored Red Delicious were generally available to consumers at a lower price than highly colored fruit of the same quality, an educational effort could focus on this favorable consumer incentive. However, an evaluation of a pilot educational effort would be desirable before an extensive program is considered or undertaken.

In meeting the apparent existing demand for high color, possibilities include the development of varieties with better coloring characteristics, production and cultural practices influencing color, and sorting or grading practices that are most suitable.

Appendix

Analyses

Tests of statistical reliability were applied to indicate the validity of the findings, or the confidence that may be placed in the results.

Basic data for the statistical analysis of Red Delicious apple sales are included for reference (table 3). These analyses were performed

to provide a basis for interpretation of the findings. Analysis of variance was used to obtain and assign the existing variation in sales to specific components. This analysis of test apple sales indicated that differences in sales due to treatments were highly significant (table 4). Variation existing in the "treatments" component (i.e., variation between different color ranges) was further analyzed by the least significant difference test (table 5). Additional analyses in which adjustments in sales were made for differences in number of customers for the three color ranges, resulted in no significant differences from the findings for sales alone, as the number of customers did not vary to a significant extent between treatments.

A further analysis of variance indicated no significant difference in sales of other apples when the different color ranges of test apples were tested.

TABLE 3.—*Experimental design and apple sales by treatment, 9 retail food stores, Atlanta, Ga., Oct. 30-Dec. 9, 1961*

Stores	Experiment periods					
	Oct. 30-Nov. 11		Nov. 13-Nov. 25		Nov. 27-Dec. 9	
	Treat- ment ¹	Sales	Treat- ment ¹	Sales	Treat- ment ¹	Sales
		<i>Pounds</i>		<i>Pounds</i>		<i>Pounds</i>
First replication:						
Store 1-----	A-----	779	B-----	496	C-----	424
Store 2-----	B-----	312	C-----	314	A-----	238
Store 3-----	C-----	803	A-----	599	B-----	314
Second replication:						
Store 4-----	A-----	703	C-----	416	B-----	319
Store 5-----	B-----	376	A-----	458	C-----	276
Store 6-----	C-----	623	B-----	397	A-----	556
Third replication:						
Store 7-----	A-----	557	B-----	382	C-----	346
Store 8-----	B-----	313	C-----	489	A-----	396
Store 9-----	C-----	170	A-----	211	B-----	85

¹ Treatments represent color ranges of Red Delicious apples as follows: A, 75-100 percent good red color; B, 50-75 percent good red color; C, 50-100 percent good red color.

TABLE 4.—*Analysis of variance, test apple sales in pounds, 9 retail food stores, Atlanta, Ga., Oct. 30-Dec. 9, 1961*

Source of variation	Degrees of freedom	Mean square	F ratio
Between squares.....	2	58, 770	18. 2
Squares within squares.....	6	55, 210	17. 1
Periods within squares.....	6	34, 840	10. 8
Between periods.....	(2)	78, 628	24. 3
Periods × squares.....	(4)	12, 946	4. 0
Treatment within squares.....	6	23, 158	7. 2
Between treatments.....	(2)	63, 244	¹ 19. 6
Treatment × squares.....	(4)	3, 115	0. 96
Error.....	6	3, 234	-----
Total.....	26	-----	-----

¹ This ratio is highly significant at the 0.005 probability level.

TABLE 5.—*Least significant difference test of sales differences between selected color ranges for Red Delicious apples, in 9 retail food stores, Atlanta, Ga., Oct. 30-Dec. 9, 1961*

Comparison of average sales per store per week by selected color ranges ¹	Sales difference	Sales difference needed to attain significance at selected probability levels		
		0.001	0.02	0.05
	Pounds	Pounds	Pounds	Pounds
A (250 lbs.) vs. B (166 lbs.).....	+84	² 80	42	33
A (250 lbs.) vs. C (214 lbs.).....	+36	80	42	² 33
B (166 lbs.) vs. C (214 lbs.).....	-48	80	² 42	33

¹ Code letters represent color ranges as follows: A, 75-100 percent good red color; B, 50-75 percent good red color; C, 50-100 percent good red color.

² Highest significance attained at this level.

Other Apple Studies

Related research on apples conducted by the Market Development Branch includes: (1) Merchandising Studies in Supermarkets—Apples, Lettuce and Tomatoes, by Hugh M. Smith, AMS-18, Mar. 1955; (2) Weekly Changes in Movement of Apples—Selected Markets, 1955-56 Marketing Season Through December 31, 1955, AMS-91, Feb. 1956; (3) Measuring Weekly Changes in the Movement of Apples and Winter Pears, 1955-56 Marketing Season, by Earl E. Houseman, William S. Hoofnagle, and L. Donald McMullin, AMS-148, Feb. 1957; (4) Measuring Weekly Changes in the Wholesale and Retail Movement of Apples, by Peter L. Henderson and Sidney E. Brown, Mktg. Res. Rpt. 351, Sept. 1955, and (5) Special Promotional Programs for Apples—Their Effects on Sales of Apples and Other Fruit, by Peter L. Henderson, Sidney E. Brown, and James F. Hind, Mktg. Res. Rpt. 446, Jan. 1961.

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